I. QUALITATIVE AND QUANTITATIVE ANALYSIS OF FEEDING HABITS:

Feeding Habits of *A. clavata* on Dead Components of the Mangrove Plant, *A. marina* (Plate-44, Figs. 1-8)

Results of field sampling revealed the presence of a number of oribatid mites in association with the true mangrove plants as well as the mangrove associates from the various sites screened. The various life stages of the euphthiracarid member, *A. clavata* were found aggregated on the dead bark of *A. marina* (Plate-44, figs. 1&2), showing a very close association with the filamentous green alga, *Microspora* sp. All the life stages viz. egg, larva, three nymphal stages (proto-, deuto- and tritonymph) and their respective quiescent phases could be recovered from the algal filaments. The members of the species were found to feed simultaneously on the filaments of *Microspora* sp. as well as dead bark of *A. marina* Progressive feeding activity of various life stages of *A. clavata* was found to produce feeding tunnels on the bark of *A. marina*. (Plate-44, Figs. 3&4). The alimentary tracts of the transparent larvae and nymphs of the species were found to harbour varying numbers of green coloured food globules, on consumption of *Microspora* sp.
Observation 162

(Plate -44, fig. 5). Both the fresh and decayed filaments of Microspora sp. were found initially nibbled by the various life stages of the mite and later on exhibited voracious feeding trend (Plate- 44, fig.6). As a result of voracious feeding activity, masses of faecal pellets were found accumulated in the culture base/feeding substrate (Plate- 44, fig.7). Intensive feeding by the adults and nymphs produced large amounts of brown and green coloured faecal pellets in the culture cells. (Plate- 44, Fig. 8)

b. Food choice test: (Plate- 45, Figs.1-8)

The results of the cafeteria experiments conducted under laboratory conditions revealed the preference of A. clavata to the dead pneumatophores, on which the species fed very actively (Plate -45, fig. 1). The nymphal stages of A. clavata showed preference to leaves of A. marina and they actively fed on these and laid dark coloured faecal pellets, which were accumulated in the culture cells. The maximum number of mites could be located on dead pneumatophores of A.marina, followed by the dead bark covered with filaments of Microspora sp. and dead leaves of A. marina. Only lesser number of mites could be detected on the dead leaves of A. ilicifolius on which the presence of feeding signs was less evident. The number of mites showed an increase with the advancement of decay of the pneumatophores (Plate -45, figs. 2-4)
On the most favoured food item (dead pneumatophore of *A. marina*) the feeding activity by the larval and nymphal stages was found to commence at a low level in the initial stage and it progressively enhance to reach the maximum level from the 12th hour onwards. This feeding trend was continued along the region of cortex (gas-filled aerenchyma cells) (Plate-45, Figs.5-6a&b), the pith and xylem vessels of pneumatophore (Plate -45, Fig.6c), till the exhaustion of the feeding substrate except the the epidermal tissue and pericycle regions, which were found totally excluded and left behind in the culture cell (Plate- 45, Fig.8). The larvae and nymphs of this species were found to contain 1-3 brown coloured food boli inside their alimentary tract (Plate-45, Fig.6d). Accumulation of masses of faecal pellets was a common feature in culture cells, where the species was reared on dead pneumatophores of *A. marina*. The adults and nymphal stages exhibited more preference to the gas-filled aerenchymatous tissue of the dead pneumatophores, especially in advanced stages of decomposition and more number of mites were found congregated on such regions (Plate- 45, Fig.7) The unfed remnants of the pneumatophores accumulated in the culture cells often offered adequate ground for fungal growth (Plate- 45, Fig.8) subsequently.
C. **Feeding by Different Oribatid species on Diverse Mangrove Litter Substrates (Plate- 46, Figs. 1-8)**

In the present study, the adults of *I. (I.) punctulatus* and *P. (P.) trifoliatus* were found very actively feeding up on the decomposing woody parts of the mangrove associate plants like *C. crista* and *D. trifoliata*. Both the species produced feeding tunnels inside the decomposed bark, and these tunnels were found packed with large amount of dark brown coloured faecal pellets (Plate- 46, Figs.1-5). Most of the field collected oribatid species consumed the soft tissues of decayed pneumatophores, mangrove leaves and other littoral components. The feeding activity of members representing species like *P. (P.) capucinus*, *Nothrus* sp., *J. (J.) porosus*, and nymphs of *I. (I.) punctulatus* etc. on different litter components comprising dead mangrove leaves of *A. ilicifolius*, *A.marina* and *A. officinalis* (Plate -46, Figs. 6a-d), resulted in the skeletonization of leaf tissues, (Plate-46, Figs.7-8) formation of boring holes and tunnels on the wood, bark pneumatophores etc., ultimately leading to the conversion of these materials in to faecal pellets. Actively feeding nymphal stages of the above species also could be recovered from the small crevices and holes present on the decomposing barks and twigs of mangrove plants collected from the field.
D. Microhabitat preference/association and morphological modifications (Plate-47, Figs.1-5e)

Studies on the microhabitat preference of selected species revealed their specificity to rely on different vegetations including the spikelets of a mangrove associate grass plant, *M. javanicus*. The latter was found to grow up to 2 meters in height from the ground level and which was selected as the most preferred food item by the species, *S. (S.) malabarica* (Plate- 47, Figs.1-1c). The dead and decomposing spikelets of the grass offered the preferred microhabitat for the replenishment of the species. The dead pneumatophores of the mangrove plant, *A. marina* were found to serve as very challenging shelter to *A. clavata*. (Plate-47, Figs. 2-2c). A close association of *I. (I.) punctulatus* on dead, decomposing barks of *C. crista* was also noticed (Plate-47, Figs.3-3b). The new oribatid species viz. *P. (P.) trifoliata* sp.nov.(Plate-47, figs.4-4b) and *P. kadalundiensis* sp.nov., were found in associated with mangrove plant *D. trifoliata* and the dead leaves of twigs of *A. marina* respectively. Moreover, results of field cum laboratory observations revealed the possession of monodactylous condition in species dwelling in soil/ litter and tridactylous condition for species inhabiting arboreal (canopy dwelling) forms of oribatid mites. The littoral dwelling oribatid species like *S. mangrovius* sp.nov., possessed monodactylous condition with longer, hooked, sickle shaped claws bearing prominent proximoventral tooth. Arboreal forms
generally were characterized by tridactylous legs bearing short claws (Plate - 47, Figs.5-5e).

II. QUANTITATIVE ANALYSIS

(1) Analysis of nutrients present in soil samples (both Experimental and Control groups)

Results of quantitative analysis disclosed that the feeding activity of oribatid mites on the mangrove litter resulted in an increase in the concentration of nutrients like Nitrogen, Phosphorous and Potassium (N,P,K) 4.384 ± 0.496 ppm, 25 ± 2.78 ppm and 11.218 ± 0.606 ppm respectively. Statistical analysis of the data obtained on quantitative studies on the concentration of N, P, K in experimental and control soil samples following unpaired student ‘t’ test are presented in (Table. 6). Data were analyzed using statistical package and expressed as Mean ± Standard Deviation (SD). Two-tailed unpaired t-test were done and the values are set significant at P<0.05 and asterisks (*) denotes significant against the control group. As shown in the table.6, the data on nutrient analysis were found significant (P<0.05) thereby confirming that the oribatid feeding activity would enhance the nutrient status of mangrove soils.
III. POST EMBRYONIC DEVELOPMENTAL STUDIES:

A. Postembryonic Development of *H. epimeratus* sp.nov. (Plate-48; Plate –49, Figs. 1-8)

1. Oviposition, Incubation and Hatching

The adult males (Plate-49, Fig.1) deposited stalked spermatophores on and around the litter residues of *A. marina* and *A. ilicifolius*, on the culture base, on surfaces of dead/ decaying leaves and so on. The spermatophores laid in the culture cell looked like dew drops having globular shining heads on thin, erect stalks (Plate-49, Fig.2). Gravid females of *H. epimeratus* laid eggs singly in concealed habitats like the small crevices on bark, small twigs and under litter particles, which were offered as feeding substrates within the culture cells. Quite often, eggs were observed in between grains of sand and under the litter residues offered as food at the base of the culture cells. Eggs were very small, transparent and milky- white in colour. During progressive days of incubation, the colour of eggs got changed from white to pale brown and later to brown in colour prior to hatching. The initiation of the hatching was marked by gradual weakening of the outer membrane and appearance of a longitudinal slit along the egg pole. The wriggling and threshing movements of the larva inside the eggshell helped in widening of the slit for easy emergence.
2. **Duration of Life Stages (Table.7; Plate-48)**

The newly hatched larva was very delicate, pale brown in colour and with a wrinkled, soft, plicate integument. It could be easily distinguished by its hexapodous nature. Immediately after hatching, the larva remained inactive for 15-20 minutes and tried to hide itself always under the litter residues (decayed leaf of *A. marina*) and small cracks in the culture cells. Later it initiated feeding on very small litter residues scattered over the grains of sand within the culture cells. The active feeding period of larva extended for 5-6 days and then it became sluggish, almost stopped feeding its body became slightly swollen and it entered in to a period of physiological inactive phase called the 1\textsuperscript{st} quiescent phase/stage. This dormant period lasted for 4–5 days and the end of which was marked by the moulting process marked by the appearance of prosterolateral slit on either sides of the notogaster. The protonymph emerged subsequent to moulting of larva was an octapod, slightly larger than the larva and transparent with a wrinkled integument. The protonymph remained active for 10 – 13 days by feeding on the litter residues and then became quiescent (2\textsuperscript{nd} quiescent stage) for 5 – 6 days and subsequently moulted in to the succeeding nymphal stage called the deutonymph. The deutonymph was comparatively larger in size and more active than the previous stage. The deutonymphs were found aggregated onto the droplets of saline water adhered to the walls/lids of culture cells. The colour of the deutonymph gradually got changed from pale to brown. After an
active feeding period of 14 – 19 days, it entered into a period of quiescence (3rd quiescent stage), which lasted for 4 – 7 days. On subsequent moulting, the tritonymph which was the largest among the nymphal instars and was more sclerotized. The active feeding period of the tritonymph lasted for 15 – 19 days. Then the tritonymph passed through the 4th quiescent phase of 5 – 6 days and underwent the final moulting to give rise to the adult individual. The adult mites were densely dark brown in colour and they preferred to feed on the litter residues of dead leaves of *A. marina* and *A. ilicifolius*. Thus during the present study, the life cycle of *H. epimeratus* was found to complete within 82 – 102 days, under laboratory conditions of 27±2°C and 79±2% RH. The newly emerged adult female initiated oviposition after 17-21 days of emergence. Therefore, the total duration of F1 generation of *H.epimeratus* sp.nov. was found ranging from 99-123days.

**Morphological Description of Life Stages of H.epimeratus gen.nov. sp.nov.**

(Table.8-12; Plate-49, Figs. 1-8; Plates-50&51, Figs. 1-4)

**EGG**

(Plate-49; Fig.3)

Measurements: Length: 107 -111 μm  
Width: 56 - 59 μm

Eggs were oval in appearance, white and transparent, glittering with porose surface when viewed under higher magnification.
Observation

LARVA

(Plate-49, Fig. 4)

Measurements: Length: 125-127\(\mu\)m
Width: 87 – 91 \(\mu\)m

The newly emerged larva could be differentiated easily based on the presence of 3 pairs of legs, small sized body, creamy white colouration and the translucent nature of the body.

Dorsal Region (Plate-50, Fig.1)

Prodorsum

Prodorsum triangular in appearance and produced into conical rostrum, prodorsal surface ornamented with small cerotegumental granules; setae \(ro, in\) and \(le\) almost equal in size while setae \(in\) and \(ex\) minute; bothridial cups opened laterally from which sprouts the short stalk of the sensillus, the head of the latter bears small spines.

Notogaster

Notogaster more or less oval in appearance with a wrinkled integument, 11 pairs of setae \((c_1, c_2, c_3, da, dm, dp, la, lm, lp, h_1, h_2, h_3)\) inserted on the notogaster, all minute; integument of notogaster ornamented with small granules; centrodorsal plate with transverse ridges, running up to posterior margin of the notogaster.
Ventral Region (Plate-50, Fig.2)

Infracapitulum diarthric type, seta $h$ detected, setae $m$ and $a$ absent; Ventral integument finely granular; epimeral setal formula 2-1-1, epimeral surface granular; claparede’s organ globular; genital, aggenital, anal and adanal setae not developed.

Legs

Legs 3 pairs, all monodactylous, claws hook like.

PROTONYMPH

(Plate -49, Fig. 5)

Protonymphs could be distinguished from the larval stage by the possession of 4 pairs of legs, slightly larger size of body, presence of a pair of genital suckers and pale brown colouration of the body.

Measurements: Length: 146 -150 μm

Width: 97 - 102 μm

Dorsal Region (Plate-50, Fig.3)

Prodorsum

Rostrum rounded; prodorsal cerotegument granular; lamellae visible as narrow lines, seta $le$ small, inserted at the tip of the lamella; bothridial cups
well developed, sensillus with a spined head, the stalk of sensillus relatively longer than that of the larva.

**Notogaster**

Notogaster bears 15 pairs of minute setae ($c_1, c_2, c_3, da, dm, dp, la, lm, lp, h_1, h_2, h_3, p_1, p_2, p_3$), setae $la, lm$, and $lp$ located at the latero-posterior margins of centrodorsal plate; integument of anterior notogastral region wrinkled (folded); centrodorsal plate surface finely granular.

**Ventral Region** (Plate-50, Fig.4)

Infracapitulum oval shaped, bears 3 pairs of setae, $h, m$ and $a$, all thin and smooth; seta $h$ longer than other setae; epimeral setation 3-1-2-1, setae $1c, 3b$ and $4a$ newly added at this stage), lateral epimeral surface bears dense granules; genital plates developed with a pair of small setae ($g_1$); anal and adanal setae not developed; anogenital integument wrinkled (folded).

**Legs**

Legs 4 pairs, all monodactylous, with hooked claws.

**DEUTONYMPH**

**(Plate -49, Fig. 7)**

Deutonymph was easily distinguishable from the preceding nymphal stage by its increased larger size, brown colour of the integument and presence of 2 pairs of genital suckers.
Studies on the Oribatid mites (Acari: Oribatei) Associated with Mangrove Ecosystems of North Kerala

Measurements:
- Length: 179 - 187 µm
- Width: 108 - 112 µm

**Dorsal Region** (Plate-51, Fig.1)

**Prodorsum**

Prodorsum conical in appearance and extended anteriorly into a rounded rostrum; prodorsal setae simple and smooth; lamellae well developed and connected by a narrow translamellar line; entire prodorsal surface ornamented with conspicuous ceroteugmental granules.

**Notogaster**

The shape of the notogaster resembled that of the previous instar, 15 pair of minute setae inserted on the notogaster as shown in (Plate-51, Fig.1); the shape and size of notogastral setae resembled those of the protonymph; median part of the notogastral surface less granulated in appearance.

**Ventral Region** (Plate-51, Fig.2)

Infracapitulum with 3 pairs of setae $h$, $m$, and $a$, all setae thin and smooth; Epimeral surface granulated, epimeral setal formula 3-1-2-2, all setae smooth, minute; genital setae 2 pairs ($g_1$-$g_2$); anal setae vestigial; 1 pair of aggenital setae ($ag_1$) present; 2 pairs of adanal setae ($ad_1$, $ad_2$) present; adanal lyrifissure ($iad$) located at the anterior margin of the anal plate.
Legs

All legs monodactylous with hooked claws.

**TRITONYMPH**

*(Plate 49; Fig.8)*

Tritonymphs could be differentiated from the deutonymphal stage by its larger size, brown colour of the integument and presence of 3 pairs of genital suckers.

Measurements:

- Length: 212 - 217 μm
- Width: 129 - 137 μm

**Dorsal Region** *(Plate-51, Fig.3)*

**Prodorsum**

Rostrum rounded; all prodorsal setae well developed; lamellar ridges well developed and connected by a conspicuous translamella; sensillus with a prominent clavate, finely barbed head; prodorsal integument densely granulated.

**Notogaster**

Notogaster with 15 pairs of setae, arranged as shown in *(Plate-51, Fig.3)*, all setae much longer than from previous stage; notogastral integument
marked with small circular depressions, arranged in a tuberculated pattern; antero- lateral sides of the notogaster provided with numerous folds.

**Ventral Region** (Plate-51, Fig.4)

Infracapitulum diarthric type, bearing 3 pairs of simple, smooth setae \( h, m \) and \( a \); Epimeral surface ornamented with dense granulation; epimeral setal formula 3-1-2-2, all setae smooth, minute; genital setae 4 pairs (\( g_1-g_4 \)); aggenital setae 1 pair; anal setae 2 (\( an_1 & an_2 \)) pairs, 3 pairs of adanal setae (\( ad_1, ad_3 \)) present; fissure \( iad \) located at the anterior margin of the anal plate.

**Legs**

All legs monodactylous

**Common Features of the Juvenile Stages of Intertidal Oribatid Mites**

(Plate-52, Figs.1-6)

The larva and all juveniles of the intertidal oribatid mites are generally called as “Aphereredermous” which means that they are plicate and soft bodied. A detailed study on the morphological characters of the juvenile instars of \( H. epimeratus \) disclosed that the juvenile stages share certain common features like the possession of a rounded rostrum, triangular prodorsum, finely granulated nature of the anterior region of the body, short and simple nature of prodorsal setae including setae \( ex \) and \( in \), cup like laterally opened bothridia, presence of numerous pores of the underlying fine tracheal tubes/
channels at the median prodorsal border, possession of monodactylous legs bearing hook-like claws etc. Hysterosomal lyrifissures were not visible in any of the juvenile stages. Centrodorsal plate finely granular and some slightly large sized granules present in folds, furrows.

B. Postembryonic Development of *A. clavata* (Märkel, 1964) on dead Pneumatophores and Filamentous Green Alga, *Microspora* sp. (Plate-53; Plate-54, Figs.1-8)

3. Larviposition

An interesting observation made on the life history of *A. clavata* was the absence of oviposition within the culture cells, unlike the other species of oribatid mites. The gravid females carried oval-shaped eggs inside their body, which contained embryos which gradually developed into pre-larva. After 14-18 days of development within the body cavity of the female mite, larviposition was observed, which resulted in the birth of a fully developed six-legged larva.

4. Duration of Life Stages (Table.13; Plate-53)

The newly emerged larva was very delicate in nature and remained inactive for about 10 minutes. Then it crawled on the substratum, and started wandering inside the culture cell in search of food. It showed preference to feed on both fresh and dead algal filaments of *Microspora* sp. and the cortex
tissue of the pneumatophore of A. marina After 5-6 days of active feeding, the larva became completely immobile and enlarge their body size and moved into 1st quiescent stage. The larval quiescence extended for for 3-5 days and which was ended by the moulting process and moult into protonymph stage. The active period of the protonymph lasted for 3-4 days and then it retarded its feeding activity, became sluggish, transformed its body in to a turgid condition and entered in to the 2nd quiescent phase of 5-6 days duration. On subsequent moulting, the deutonymph emerged and the latter was a voracious feeder on the various food items provided. Intensive feeding was evident through the formation of food boli within the digestive tract and which could be clearly perceived through the transparent body of the deutonymph. The pure white colour of the deutonymph later got changed to off-white. After an active feeding period of 3-5 days, it entered into the 3rd quiescent phase of 6-9 days duration. The 3rd quiescent stage moulted in to the transparent tritonymphal stage and which was recognized as the largest among all other nymphal stages. The tritonymph exhibited active feeding on the dead pneumatophores for a period of 10-11 days and then it passed through the 4th and final quiescent stage of 7-9 days duration and moulted in to the light brown coloured adult. Under laboratory conditions of 27±2°C and 79± 2% RH, A. clavata completed its development from egg to adult within 61-72 days. The newly emerged females produced eggs after 8-11days of their emergence, but these eggs remained inside their body cavity and were not
deposited, but such gravid females showed larviposition, giving birth to fully mature larvae.

Morphological Description of Life Stages of *A. clavata* (Märkel, 1964)

(Table.14-18; Plate-54, Figs.1-8; Plate-55, Figs.1-4)

**EGG**

(Plate-54; Figs.1-1a)

<table>
<thead>
<tr>
<th>Measurements</th>
<th>: Length: 173-185 µm</th>
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<tr>
<td></td>
<td>Width: 57 - 62 µm</td>
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</table>

Eggs were small, oval, white, transparent and found inside the body of the adult female.

**PRELARVA**

(Plate-54; Fig.2)

Detected inside the body of weakly sclerotized females. Prelarva more or less oval in appearance, enclosed inside the eggshell and found to possess 3 pairs of monodactylyous legs.

**LARVA**

(Plate-54; Fig.3)

The larva could be easily distinguished by the possession of 3 pairs of legs. The cuticle of the larva was weakly sclerotized, colourless and smooth.
The rutella of subcapitulum and its digits showed very little sclerotization and appeared as light brown coloured.

**Observation**

**Measurements**

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<table>
<thead>
<tr>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Length:</td>
<td>173-186 µm</td>
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<tr>
<td>Width:</td>
<td>74 – 82 µm</td>
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**Dorsal Region** (Plate-55, Fig.1)

**Prodorsum**

Prodorsum relatively short with a broadly round rostrum; setae *ro*, *le* and *in* long, setiform and smooth; seta *ro* inserted at the tip of rostrum, seta *le* inserted anteromedial to seta *in*; length of setae varies in the sequence *in* > *ro* > *le*; bothridial cups not well developed; seta *ex* inconspicuous.

**Notogaster**

Notogaster with 10 pairs of setae (*c₁*, *c₂*, *c₃*, *cₚ*, *d₁*, *d₂*, *e₁*, *e₂*, *h₁* & *h₂*) setae *ps₁*, *ps₂* & *ps₃* absent.

**Ventral region:**

Infracapitulum stenarthric, setae *h*, *m*, *a* setiform, smooth, setae *m* little shorter than the other; epimeres with paired, smooth plates having weakly defined borders, Epimeral setal formula 3-1-2, all setae setiform, smooth, with flagellate tip; genital, aggenital, anal and adanal setae not developed.
Legs

All legs monodactylous.

**PROTONYMPH**

*(Plate- 54; Figs.3b,4a&b)*

Protonymph appears larger than the larva and easily identified by the presence of 4 pairs of legs. Body almost cylindrical in appearance, and not ptychoid. The protonymph possesses 1 pair of genital sucker.

**Measurements**

- Length: 270 -292 μm
- Width: 119 - 128 μm

**Dorsal Region** *(Plate-55, Fig.2)*

**Prodorsum**

Prodorsum comparatively short and reaching about half the length of the notogaster; rostrum widely rounded, all prodorsal setae, smooth with flagellate tip; length of setae *in* > *ro* > *le*; bothridium and setae *ex* present.

**Notogaster**

Notogastral surface smooth, 14 pairs of smooth setae inserted on the notogaster as shown in *(Plate-55, Fig.2)*, setae *h*, *ps*, *ps* and *ps* newly added in this stage, setae *e*, *h* longest, other setae much shorter; distinct simple transverse linear groove (*ar*) present, posterior to setae of *e* - series.
**Ventral region**

Infracapitulum stenarthric, setae \( h, m, a \) setiform and smooth; Epimeral plates with weakly defined borders; epimeral setal formula 3-1-2-1, all setae setiform, smooth, longest with flagellate tip, 1 pair of genital setae and one pair of genital suckers present; anal and adanal setae not developed.

**DEUTONYMYP**

*(Plate-54; Figs.5a&b)*

The deutonymph was recognized easily based on the presence of 2 pairs of genital suckers and relatively larger size of the body than that of the previous stage.

**Measurements**

<table>
<thead>
<tr>
<th>Length</th>
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<tr>
<td>306 - 314 μm</td>
<td>146 - 160 μm</td>
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**Dorsal Region** *(Plate-55, Fig.3)*

**Prodorsum**

Prodorsal integument smooth; rostrum elongated; prodorsal setae smooth and of varying size, seta \( in \) the longest, length of prodorsal hairs varies in the order \( in > le > ro \); seta \( ex \) conspicuous; sensillus clavate; bothridial cups well developed.
**Observation**

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**Notogaster**

Notogastral integument delicate, smooth; number of notogastral setae same as that of the protonymphal stage, setae $e_1$, $e_2$, $h_1$-$h_3$ and $ad_1$-$ad_3$ long with flagellate tip; lyrifissures $ia$, $im$ and $ip$ clearly visible in lateral view.

**Ventral region**

Infracapitum stenarthric type, bearing 3 pairs of simple, smooth setae; Epimeral setal formula 3-1-3-2, all setae smooth and setiform; genital plates with 4 pairs of simple, minute genital setae ($g_1$-$g_4$) and 2 pairs of genital suckers; 2 pairs of minute aggenital setae present on the lateral margins of the aggenital plates; 3 pairs of long, smooth, adanal setae ($ad_1$-$ad_3$) present; anal setae absent.

**TRITONYMPH**

(Plate-54; Figs.6a&b)

Body of the tritonymph off–white in colour. Tritonymph forms the largest among the juvenile stages and could be easily distinguishable based on the larger size, presence of 3 pairs of genital suckers and the off-white colouration. Tip of the rostrum sclerotized with light brown colouration.

**Measurements**

- Length: 327 -340μm
- Width: 210 - 224 μm
Dorsal Region (Plate-55, Fig.4)

Prodorsum

Prodorsum produced in to an elongated rostrum; prodorsal surface ornamented with very fine granules, prodorsal integument pale brown in colour; carinae developed as narrow line below the bothridium; all prodorsal setae well developed, smooth, setiform with flagellate tips.

Notogaster

Notogastral setae 14 pairs, setae of series \( e_1, h_1 \) and \( ps_1 \) longer than the rest; notogastral integument smooth and delicate.

Ventral Region

Infracapitulum stenarthric type with 3 pairs of simple, smooth setae; Epimeral setal formula 3-1-3-3, all setae setiform, smooth, setae \( 1b, 3c \) and \( 4c \) equal in size and with flagellate tip; anogenital plates conspicuous; 6 pairs of minute, simple genital setae \( (g_1-g_6) \) present; 3 pairs of adanal and 3 pairs of anal setae present on the fused ano-adanal plates, seta \( an_3 \) small , located near the interlocking triangle area.

Legs

All legs monodactylous.